THE VALIDITY OF THE "FOG-INDEX OF READABILITY"

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Abstract

This study aims at investigating the validity of the Fog-Index of Readability, one of the most popular readability formulas. It explores the fact that this formula is not at all sensitive to the difficulty/ease level of reading passages when their readability is changed up to a certain degree. To do so, some reading passages were selected. Then a number of multiple-choice questions were devised for each passage. The readability of the passages was changed i.e., the passages were respectively made difficult or easy by decreasing or increasing the number of sentences. The scores obtained from administering the test revealed that the subjects who took part in this study did not find the passages significantly different.

It is, indeed, necessary to resolve the confusion about the meanings of the terms 'readability' and 'legibility'. In fact, the boundaries between these two concepts have, to date, not been clearly drawn. As a result, these two terms have been used interchangeably.

Legibility

Legibility is mainly concerned with the effectiveness of the visual presentation of information. The first recorded studies of legibility were conducted over 150 years ago, but it is only during this century that psychologists and book designers have begun to investigate the possible effects that design variables might have on readability of written materials.

The great majority of these studies have been concerned with the design of continuous text which was conventionally typeset and printed by letter press. These studies served to identify a number of basic design factors which influence reading performance. Numerous studies of this type have been carried out by H. Spencer and his colleagues at the Readability of Print Researh Unit, Royal College of Art (Spencer, 1968; Spencer, 1974; Spencer and Shaw, 1971; Spencer et al, 1973). The last few years, however, have witnessed the decline of the conventionally typeset and printed document as a medium for the dissemination of scientific and technical information. Consequently new techniques of producing a printed image on paper ... and the increasing widespread use of microforms and cathode ray tube display, such as visual display units and

television (Reynolds, 1979), have seen the light of day.

The term 'legibility' has been used in several ways and has also been applied to several types of studies, ranging from the visibility and perceptibility of individual characters and words to the comprehensibility of continuous text. A passage is perceptible when the reader is capable to recognise the letters and words which form the text. As pointed out by Reynolds (1979), perceptibility is affected by three main factors, namely: type style, form, and skill of the reader.

Generally speaking, legibility concerns itself with the many factors in typography and layout which may influence the ease, speed and accuracy with which information can be read and understood (Reynolds, 1979). Amongst these factors, the following could be listed:

- Type size, weight (boldness),
- Upper and lower cases,
- Linear and letter spacing.

Additional to these characteristics are the length of the lines in terms of characters and inches, width, margin and aesthetic characteristics of typefaces.

Readability

While legibility studies aim at investigating the effect of the print type, that is, visual presentation, readability studies are concerned with ensuring that a given piece of writing reaches and affects its audience in the way that the author intends. Indeed, as Seaton (1975) asserts, communication presupposes comprehension, but the increasing variety, volume and complexity of written material make understanding more and more of a problem. Compared to legibility studies, which mainly focus on typographic and layout factors, readability studies concentrate on the linguistic factors, in particular word length and sentence length. The main purpose of readability studies is to measure the comprehensibility of a piece of writing.

Readability and Legibility

From the above discussion, it can be understood that readability and legibility studies have rather similar objectives, that is, they evaluate the degree of comprehensibility of a piece of text in order to find a way to improve it so that it can meet the needs of the potential reader. However, the way readability and legibility approach the problem differs significantly. As already stated, legibility studies are mainly concerned with typographic and layout factors. These variables are often referred to as 'format-noise'. On the other hand, readability studies concentrate on the linguistic factors, namely word length and sentence length. By contrast to format-noise, these factors are referred to as 'style-noise'. Finally, as Dale-Chall (1948) states, legibility constitutes just one aspect of readability which may increase or decrease the reading ease/difficulty of a given piece of writing. Therefore, it should not be taken as its synonym, but only as a single element of a complex whole.

Readability Formulas

Readability formulase have been devised to help write passages suitable for both children and adults. Tekfi (1987, P. 266) reports that the first appearance of children's readability formulas was due to the influence of Edward L. Thorndike (1921) who, just like his predecessors, never developed a readability formula. He also points out that the fist two studies that mark the beginning of the work on adult formulas are those carried out by Dale and Tyler (1934) and Waples and Tyler (1931). The Dale-Tyler formula was specifically developed for adults of limited reading ability. The formula they developed prompted the development of others of wider applicability.

A number of researchers have devised formulas to predict and quantify the comprehensibility of a given piece of writing for its readership. These methods are much the same in that they consist of computing the average sentence length, number of polysyllabic and monosyllabic words per a given number of sentences or the proportion of words in various vocabulary lists. These variables are considered to be the most significant elements in predicting the difficulty/ease which is likely to be experienced in

understanding a piece of written material. The basis is the fact that words with fewer syllables are easier to understand. Shorter words occur more frequently and carry more meanings than longer ones, which tend to be less familiar.

Apparently, this approach suggests that the number of long words and the number of long sentences, particularly those containing subordinate clauses, will give one a good indication of the complexity of a passage. Long sentences always have complex syntactic structures, which constitute a strain on the reader's mind. As a result, the reader may have to retain several different parts of the sentence before he can combine them in a meaningful whole.

Several definitions of readability have been suggested, especially by Gray and Leary (1935) and Klare (1963), but the classic definition of readability is, perhaps, the one formulated by Dale and Chall in 1948:

> In the broadest sense, readability is the sum total (including interactions) of all the elements of a given piece of printed material that affects the success which a group of readers have with it, the success in the extent to which they understand it, read it at optimum speed and find it interesting.

It can be inferred from this definition that the main functions of a readability formula are:

1. to indicate the legibility of printed material as well as its readability and layout;
2. to indicate the ease of reading which is due either to the interest value or the aesthetics of the writing; and
3. to indicate understanding and comprehension due to the style of wirting.

Of these three principal functions, the last one has come to be the most commonly accepted.

Readability formulas are a relatively recent development. Indeed, they are said to have originated in the 1920s. This does not mean that there was prior to that no concern about readability. Indeed, as Klare and Buck (1954) report the first instance of concern for the reader goes back to 900 AD when the Talmudists counted the number of occurrences of words and individual ideas in their scrolls. They did so because they wanted to know how many times these words occurred in an unusual sense (compared to the usual sense). However, for a scientific approach to readability, we had to wait for several centuries.

As early as 1889, N. A. Rubakin, a Russian, made a comprehensive word frequency study in over 10000 manuscripts (including letters, accounts of personal experiences, and so forth) written by soldiers, artisans and farmers. On the basis of these manuscripts, he compiled a list of 1500 words which he believed to be understood by most people. From this study, he concluded that the chief hindrances to readability were unfamiliar vocabulary and excessive use of long sentences.

Sherman (1893) was perhaps the first to speak of readability in a prophetical manner. Tekfi (1987) reports that because Sherman was a professor of literature and had to teach the history of English Literature, he was struck by the difference in form between earlier prose writers (More, Hooker, Lyle, and so on) and the approved stylists of his time (De Quincy, Macaulay, Channing, etc.) As a result, he became interested in studying sentences in terms of their length and structure. Indeed, in his book published in 1893, he made at least five important contributions to today's readability studies.

1. Sherman noticed that through time the sentences written by various writers have become considerably shorter. He found that the earlier writers, such as Fabyan, Chaucer and Lyle had an average sentence length of about 50.1 words whereas materials written by De Quency, Channing and Bartol, for example, had an average length of only 23.5 words.
2. He equated shorter sentences with readability, a factor which is taken into account in almost all readability formulas, i.e., the importance of sentence length in affecting how well written materials can be understood.
3. Sherman found that some writers such as

Macaulay and Channing were consistent in the sentence length they used. This factor is very important as it suggests the use of sampling methods instead of the evaluation of the entire work.

4. He related another trend in the development of readable sentences. He felt that the increasing trend in readability of modern style was the result of writing 'as one speaks'. Here again, today's studies completely agree with this idea.
5. Perhaps the most important of all the contributions made by Sherman is his argument that the reader must be taken into account. Again, the studies that have been conducted in the last two or three decades have kept stressing the importance of this factor.

After Sherman, Kitson (1921), who was a psychologist, made some contributions which later researchers have used to produce formulas known today. He was interested in writing's effects rather than writing as a study and considered sentence variabe as one measure of readability. As a second measure, he took into account word length measured in terms of syllables. Thus he was able to define the two measures that were going to be used thirty years later by the most successful readability formula to date, that is the Flesch Reading-Ease Formula.

Since 1920, when the serious work on readability formulas began, many formulas have been developed. Klare (1963) reports a number of them. They are Lively and Pressy (1923), Washburne and Vogel (1928), Colch (1928), Johnson (1930), Patty and Painter (1931) and Thorndike (1934). Klare (1963, P. 44) believes that the majority of the formulas developed during this period mainly used to focus on:

1. primary attention to vocabulary as a basis for predicting readability,
2. dependence on Thorndike's Teacher Word Book as the basis for measures of vocabulary difficulty, and
3. use of relatively crude criteria of reading.

Later on, between 1934 to 1938, two significant formulas were developed, namely Dale and Tyler (1934), and Gray and Leary (1935). Most of the formulas developed since then have been complicated and difficult to use. But from 1940 on, by abandoning Thornkike's word frequency values and reducing the number of variables in formulas, some easier ones have been devised. In 1938, Washburne and Morphett introduced their new formula. Other formulas were Lorge (1939) and (1948), Flesch (1943) and (1948), called Flesch Reading Ease Formula), Dale and Chall (1948), Farr, Jenkins, and Paterson (1951), Gunning (1952, known as the Fog Index of Readability), and Spache (1953).

Gray and Leary's (1935) can be considered as the most comprehensive study on readability. They took 228 factors that could possibly contribute to the difficulty/ease of reading. The factors were classified in four broad categories, namely content, style, format, and organisation. After studying these factors individually and in relation to each other, they gave a list of 17 factors that they considered important in affecting the readability of a passage. They came up with these 17 factors after administering the reading passages they had devised to approximately 1000 subjects. The following is the list of their factors:

1. average sentence length
2. percentage of easy words
3. number of words unknown to 6th grade pupils
4. number of easy words
5. number of different hard words
6. minimum syllabic sentence length
7. number of explicit sentences
8. number of 1st, 2nd, and 3rd pronouns
9. maximum syllabic sentence length
10. average syllabic sentence length
11. percentage of monosyllables
12. number of sentences per paragraph
13. percentage of different words unknown to 6th grade pupils
14. number of simple sentences
15. percentage of different words
16. percentage of polysyllables
17. number of prepositional phrases

After 1960, a number of new formulas, some of which had general application and others which could be used in specific fields, were developed. Jackson's (1961) formula was intended to determine the readability level of Chemistry and Physics textbooks and Roger's (1962) formula could predict the comprehension level of materials to be presented orally. Fry (1968 later extended in 1977), is a readability graph for determining the level at which a particular text can be used. Another measure of readability, called Smog Formula, was introduced by McLaughlin in 1969. Raygor devised a readability graph which was much like the Fry Graph in 1977.

What is important in all these formulas is the fact that the majority of them deal with the length of sentences together with the number of syllables in words. As Alderson (1986) points out the rationale, construction and validity of these formulas are not very much different. They put emphasis on the point that if a text consists of longer sentences with too many long words, it is necessarily more difficult. Moreover, studies conducted for comparing these formulas have mostly indicated a high correlation among them. They are not that different as is clear from Mirzaee (1991), who proved that they are not different and they produce the same results when applied to reading passages in a general English course in high schools in the Islamic Republic of Iran.

Daniels (1996, P. 61) discusses investigations into the ability of students to understand their science texts and outlines some research, both in Jamaica and Australia, which suggests that there is need for concern by teachers about the value to students of some of the written materials provided for them. He points out that students might have problems both with the technical terminology and the style of writing.

> There has been interest over a considerable time in the problems which students are thought to have with the understanding of written resources in science. One problem has been perceived to be the particular register, or variation commonly used in scientific writing in the use of language so that it is appropriate for the purpose, the situation and the intended audience. There appear to be two alternative approaches to this problem: one is to deliberately introduce students to the register, as in the genre-based approach of the Science & Literacy project; Met West, (Sturgiss & Daniels 1994) whilst the alternative is to simplify the language and register used, whilst not diluting the conceptual level of the material (O'Toole, 1993). The argument in favour of the former approach is that students have a need to understand the particular register used by scientists, and that science is unthinkable without the technical language it has developed to construct its alternative world view (Martin, 1993), whilst one of the arguments used for the alternative approach is that scientific writings, which used to be in a more 'normal' register, are once again tending to move in that direction.

Mosenthal and Kirsch (1998), quoting Edgar Dale state that readability is as old as the hills and the written stories that have described them. They believe that this notion of readability was, in fact, the ease of understanding based on an author's style of writing and the organisation of his/her ideas. According to Mosenthal and Kirsch (1998), this approach to readability has been mostly applied to such materials as exposition and narratives. However, little if any success has been achieved in the ability to measure the readability of information organised in row-and-column formats: materials such as lists, schedules, tables, graphs, charts, indexes, time lines, maps, calendars, and forms (P. 638).

Applications of Readability Formulas

Readability formulas have had a wide range of applications. The most important ones are described below:

1. Ordering reading materials

At the outset, readability formula were mainly applied to evaluate the readability of ordinary reading materials. In the educational setting, it is necessary to consider the ease level of textbooks assigned for a particular group of learners. In a study by Chiang-Soong and Yager (1993), readability levels for the twelve most-used science textbooks in secondary schools were assessed according to readability graphs devised by Fry and Raygor. These science educators found that four out of the twelve textbooks studied were not satisfactory when considered in terms of their intended grade level. In another study of high school physics textbooks, Kennedy (1979) found that six out of ten high school physics books had readability levels that extended into the college level. Kennedy recommends that teachers use Fry's Readability Graph to determine the reading level of particular texts and match students appropriately.

Spinks and Wells (1993) compare the readability of textbooks used at different college levels. They conclude that reading level should be an important consideration in textbook selection. They argue that, the relationship between textbook readability, levels and the grades obtained by students is clear, though it cannot be strongly claimed that textbook readability plays the only role in determining the grades obtained in causing students to withdraw from those courses.

2. Testing the readability in word processing systems

The development of information technology, and word processing systems in particular has in recent years, stimulated the study of the effects of features such as bold face, highlighting, right-justified texts, and so on, on readability. Research in this area indicates that word processing software can make writing easier and actually adds to the clarity and readability of the message.

3. Evaluation of readability of scientific journals

In the last three or four decades, however, the ever-increasing number of readability formulas and their widespread use also attracted the interest of information scientists. In their attempt to understand the growth, distribution and characteristics of the scientific journal, information scientists, and to a lesser degree, librarians, have been concerned with the study of the printed journal. It is believed that the readability of scientific journals has become a major problem. In their study, Bottle, et al (1983) summarised the matter well when they stated that 'anyone who has looked at a pre-war chemical paper, and especially one published before 1914, is immediately struck by how much easier it is to read than today's papers, even those where one is familiar with the subject matter.

The Present Study

When compiling books and writing articles for a certain audience, a number of factors should be borne in mind. Among these factors, taking into account the reading of the potential readers is of paramount importance. If this requirement is met, the readers can read and completely understand the print and the writer is sure that he has been able to convey his message. To this end, a number of readability formulas have been developed and as discussed earlier, most of them focus on surface structure of the reading materials. It is necessary then to evaluate these formulas.

The present study is aimed at evaluating one of the most known readability formulas, the Fog-Index of Readability. This formula was developed by Gunning in 1952. The factors considered in this formula are:

1. number of sentences in a passage
2. total number of words
3. number of three and more syllable words.

The Fog-Index of Readability is:

$$\frac{\text{No. of words}}{\text{No. of sentences}} + \frac{\text{No. of 3-syllable words}}{\text{No. of words}} \times 40$$

The research question is whether this formula is sensitive enough for determining exactly the level of difficulty/ease of written materials.

Hypothesis

The null hypothesis is that there is no relationship between the ease/difficulty level of reading passages, as measured by this formula, and the students' comprehension of them.

That is to say, even if the passages become easier or more difficult, according to this formula, the comprehension of the students is not affected.

Method

Instrumentation

The reading passages employed in this study taken from General English course-books to ensure that they are at the understanding level of the subjects. These passages are on general topics. In order to prepare the three forms of tests administered in this study, the following procedures were considered:

1. Six passages were selected and 34 multiple-choice questions were constructed. These passages were labelled 1 to 6. Using the Fog-Index of Readability, the readability of these six passages was calculated. Table 1 shows the readability index of these six passages.
2. Three of these six passages (passages 1, 4, and 6) were randomly selected and made simple by increasing the number of sentences. These passages have been called MS, Made-Simple passages. The average readability index of these three passages fell to 18.64 from the original index of 25.06.
   It is worth paying attention to the fact that if the number of sentences in a passage is increased by 1 without changing the number of words, the readability index of that passage will decrease by $\frac{-n}{s(s+1)}$, ('n' stands for the number of sentences in a passage). This means that the passage will become easier. Conversely, if the number of sentences in a passage is decreased by 1, the readability index of that passage increases by $\frac{+n}{s(s+1)}$, that is, the passage becomes more difficult.
3. By using the same technique, the remaining three passages, that is, passages 2, 3, and 5, were made difficult. The average readability index of these made-difficult (MD) passages rose to 36.77.

   The average readability index of these six passages turned out to be 25.70.

   The three forms of tests contain a variety of passages as follows:

   Form A: 2 UC (unchanged) passages, and 2 MS passages (23 mulliple-choice questions)

   Form B: 2 UC passages, 1 MS passage and 1 MD passage, (21 multiple-choice questions)

   Form C: 2 UC passages and 2 MD passages (24 multiple-choice questions)

Table 1. The readability index of the 6 passages originally selected for the instrumentation

PASSAGE	NO. OF WORDS	NO. OF SENTENCES	NO. OF 3-SYLLABLE WORDS	READABILITY
1	172	7	14	27.83
2	164	7	13	26.60
3	133	5	13	30.51
4	186	9	13	23.46
5	207	11	16	21.91
6	258	13	26	23.88

Table 2. shows the details of the readability indices of all passages.

Table 2. The readability of UC, MS and MD passage

PASSAGES	READABILITY OF UC PASSAGES	READABILITY OF MS PASSAGES	READABILITY OF MD PASSAGES
1	27.83	20.46	----
2	26.60	----	44.17
3	30.51	----	36.16
4	23.46	17.10	----
5	21.91	----	28.97
6	23.88	18.36	----

4. Three forms of tests called A, B, and C have been developed with these 12 passages (6 UC, 3MS, and 3MD).

   Tables 3 and 4 show the characteristics of each passage in each form together with the number of questions devised for each passage. Letters A, B, and C indicate the Test Forms and numbers 1, 2, 3

and 4 show the number of photographs in each form. Thus 'A1' means the first passage in form A. Moreover, the first column in these two tables represent the UC passages; the second column indicates that the same passages have been changed into MS or MD respectively.

Table 3. The location of UC passages which have been changed into MS passages in each Test Form.

NO.	UC PASSAGES	MS PASSAGES	NO OF QUESTIONS
1	A1	B2	5
2	C1	A2	8
3	C3	A4	5
		TOTAL	18

Table 4. The location of UC passages which have been changed into MD passages in each Test Form.

NO.	UC PASSAGES	MD PASSAGES	NO OF QUESTIONS
1	A3	B4	5
2	B3	C4	6
3	B1	C2	5
----	----	TOTAL	16

The average readability of passages in Forms A, B, and C are 22.47 , 29.26 , and 28.37 respectively.

Table 5 shows the readability index of each passage in each form together with the average readability of all passages in each form.

Table 5. The readability index of each passage in each form together with the average readability of all passages in each form

TEST FORM	PASSAGE 1	PASSAGE 2	PASSAGE 3	PASSAGE 4	AVERAGE
Form A	27.83	17.10	26.60	18.36	22.47
Form B	30.51	20.46	21.91	44.17	29.26
Form C	23.46	37.16	23.88	28.97	28.37

Subjects

The subjects who kindly accepted to read the passages and answer the multiple-choice questions are 60 volunteer English majors studying in their third semester. Each form of the test was answered by 20 students. Care was taken to ensure that the students were homogenous so that the results to be obtained would be valid and reliable.

Data Collection

In order to collect data, the three forms of tests were administered. To do so, the subjects were given a limited amount of time, 20 minutes, to read the passages and answer the questions. Forty of the subjects answered the questions in their Reading Comprehension class and 20 of them in their Writing class. The subjects were told that the test was a part of their course evaluation in order to ensure that they are more careful in answering the questions. They were required to indicate their preferred answer to each question on the answer-sheet provided.

Table 6. The comparison between the scores of the subjects in UC and MS passages

NO OF SUBJECTS	SCORES OF THE SUBJECTS IN UC PASSAGES A1 , C1 , C3	SCORES OF THE SUBJECTS IN MS PASSAGES B2, A2, A4
1	14	15
2	14	14
3	13	13
4	13	12
5	13	11
6	12	11
7	12	10
8	11	10
9	11	9
10	10	8
11	9	8
12	9	8
13	8	7
14	8	7
15	8	6
16	8	6
17	6	6
18	5	6
19	5	5
20	4	5

Mean of the scores in UC passages: 9.65.
Mean of the scores in MS passages: 8.7.

Later the answer-sheets were carefully corrected and scored. Table 6 shows the scores of the subjects in 3 UC passages along with their scores in the 3 corresponding MS passages. Likewise, Table 7 indicates the scores of the subjects in 3 UC passages together with the 3 corresponding MD passages.

Table 7. The comparison between the scores of the subjects in UC and MD passages

NO OF SUBJECTS	SCORES OF THE SUBJECTS IN UC PASSAGES A1 , C1 , C3 16 QUESTIONS	SCORES OF THE SUBJECTS IN MD PASSAGES B2, A2, A4 16 QUESTIONS
1	14	13
2	14	13
3	14	12
4	14	12
5	13	10
6	12	9
7	12	9
8	12	8
9	11	8
10	11	8
11	10	7
12	10	7
13	10	7
14	9	7
15	8	7
16	8	5
17	5	5
18	4	4
19	3	4
20	3	4

Mean of the scores in UC passages: 9.85.
Mean of the scores in MD passages: 7.95.

Results

In order to analyze the data obtained from the scores of the subjecfs, statistical measures were applied. First, a t-test was administered to see if there is any significant difference between the two sets of 3 UC passages which have been changed into MS and MD ones. The means of the two were 9.65 and 9.85 with the standard deviations of 3.13 and 3.66 respectively. The 't value' obtained was 0.94. By referring to the relevant statistical tables, it was observed that the critical value for 't', when α=0.05, which is 2.093 is far more than the t-observed. Thus, it can be concluded that there is no significant difference between these two sets of scores. Therefore, if any of these two is utilised in doing the comparison between the scores in UC and those in other passages (MS and MD), the results will not be affected.

Next, an ANOVA was applied to compare the means of the scores in UC, MS and MD passages. In the first place, the higher mean of scores, 9.85 was used. The 'F' ratio turned out to be 1.73532. In the second place, the lower mean was employed; the 'F' ratio turned out to be 1.5504. The comparison between these Fs obtained and the 'F' critical in the 0.05 level given in the F-distribution (ANOVA) tables, which is 4.03, confirms the null hypothesis of this study. Therefore, it can be said that the Fog-Index of readability is not at all sensitive to the changes in difficulty/ease level of the passages when the readability indices fall between 17.1 and 44.17, the lowest and the highest readability indices of the passages employed in the present study.

As discussed earlier, most readability formulas take into account the sentence length, number of words, and number of polysyllabic words as their criteria. As it has already been mentioned, Alderson (1986) argues that the rationale, construction and validity of these formulas are not very much different. They put emphasis on the point that if a text consists of longer sentences with too many long words, it is necessarily more difficult to process. Moreover, the studies conducted for comparing these formulas have mostly indicated high correlation among them (Mirzaee, 1991). Therefore, if we generalise the findings of this study, the same must be true of other readability formulas.

It seems that there should be more attempts to devise other techniques for identifying the readability of reading passages. This becomes more serious when materials are to be used for teaching purposes. One possible solution is that suggested by Akbari, et al. (1997) who propose using discourse elements to determine the readability of texts. This, of

course, requires more detailed and thorough studies to find the role of multiple themes, clauses as themes, unmarked and marked structures which reading texts may contain.

Recommendations

The following recommendations seem to be useful in determining the factors involved in ease/difficulty level of reading passages.

1. Other factors involved in the readability of passages should be investigated so that textbook selection centers and textbook compilers can find passages appropriate for their intended users.
2. Using the same procedure, research must be conducted on vocabulary items by increasing and decreasing the number of multi-syllables in some texts to see if these changes, which normally result in changes in readability, affect the students' reading comprehension.
3. As Mosenthal and Kirsch (1998) point out, little if any success has been achieved in the ability to measure the readability of information organised in row-and-column formats: materials such as lists, schedules, tables, graphs, charts, indexes, time lines, maps, calendars, and forms (P. 638). Further attempts are needed to find measures for calculating the readability of these materials.

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